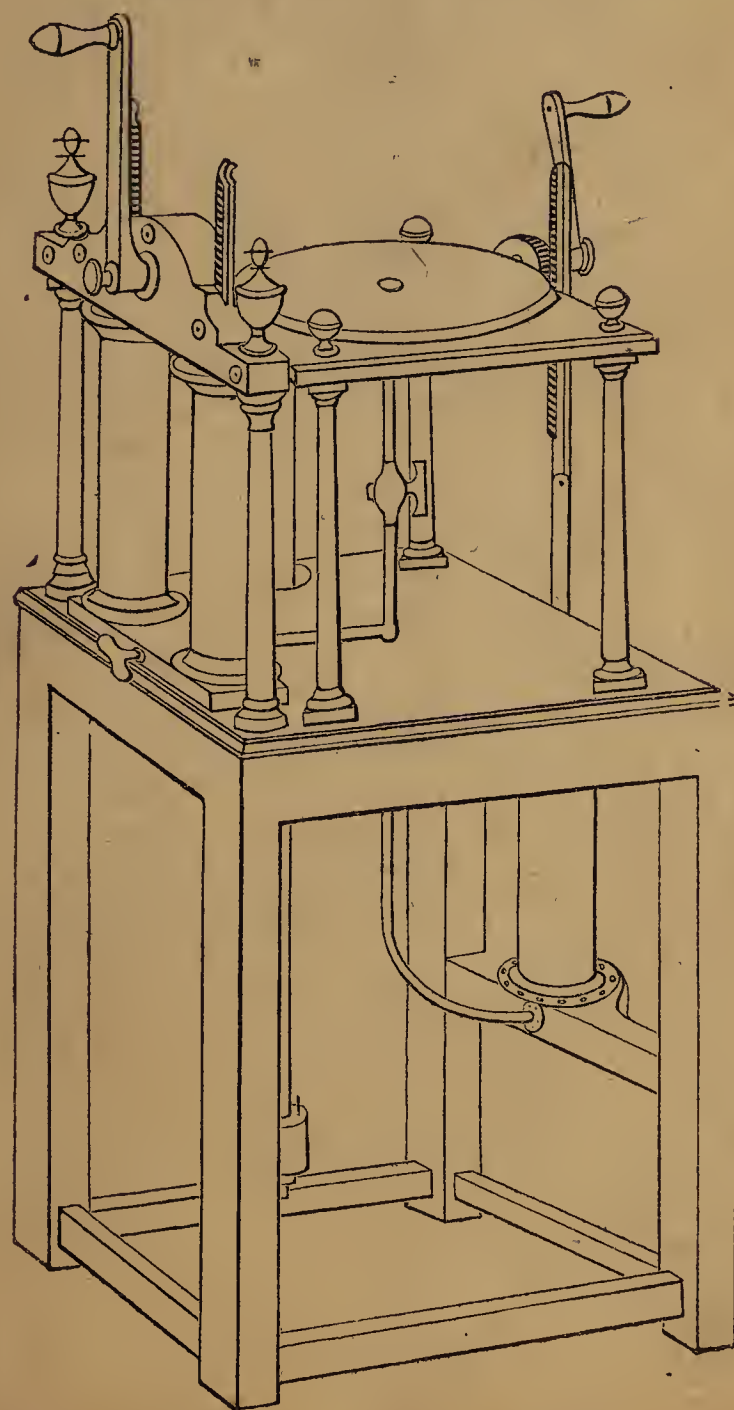


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DESCRIPTIVE CATALOGUE
OF
HYDROSTATIC, HYDRAULIC, PNEUMATIC,
AND
ACOUSTIC INSTRUMENTS
CONSTRUCTED AND SOLD BY
WATKINS AND HILL,
5 CHARING CROSS, LONDON.



Illustrated by 112 Engravings.

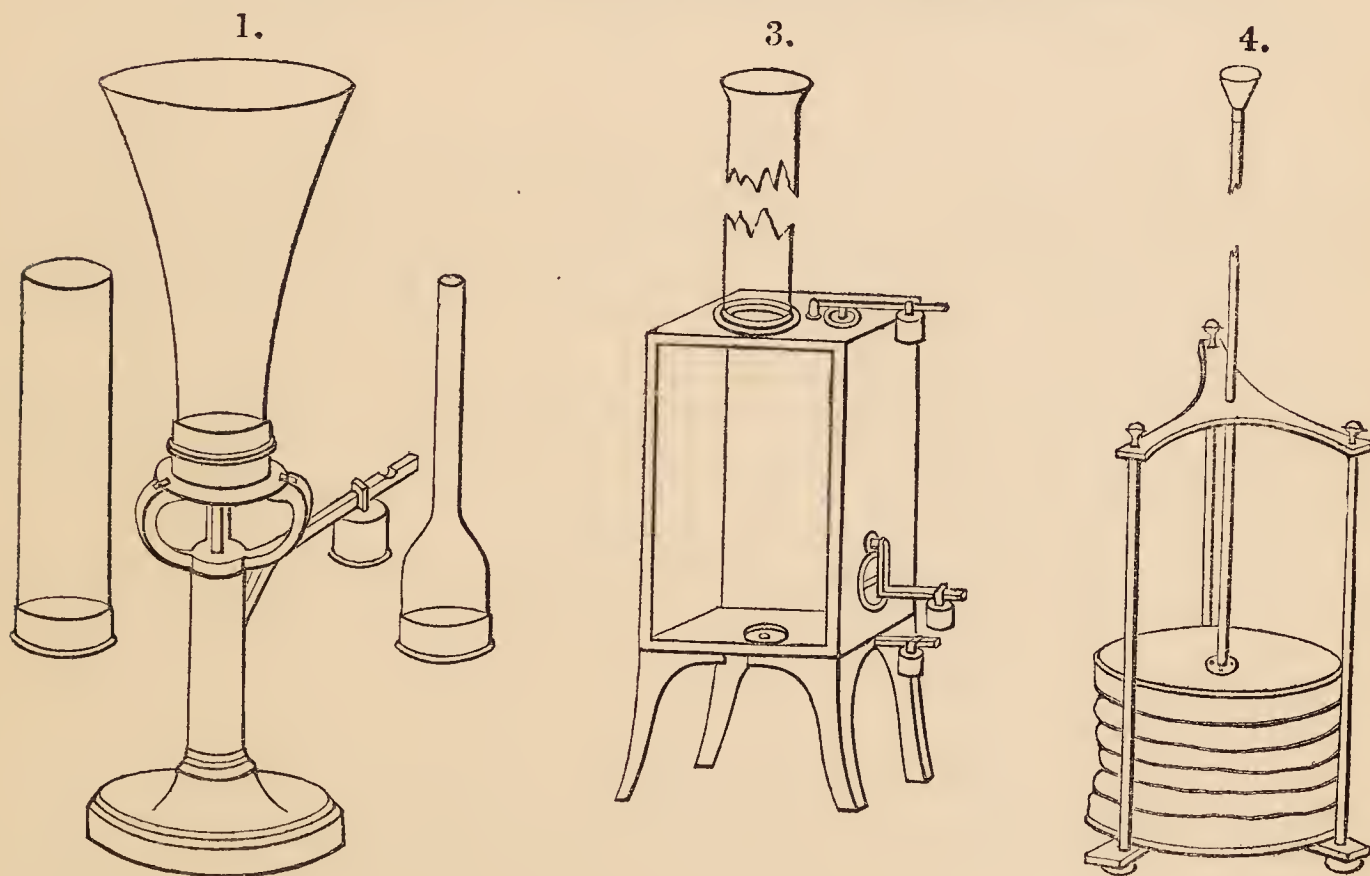
Price Sixpence.

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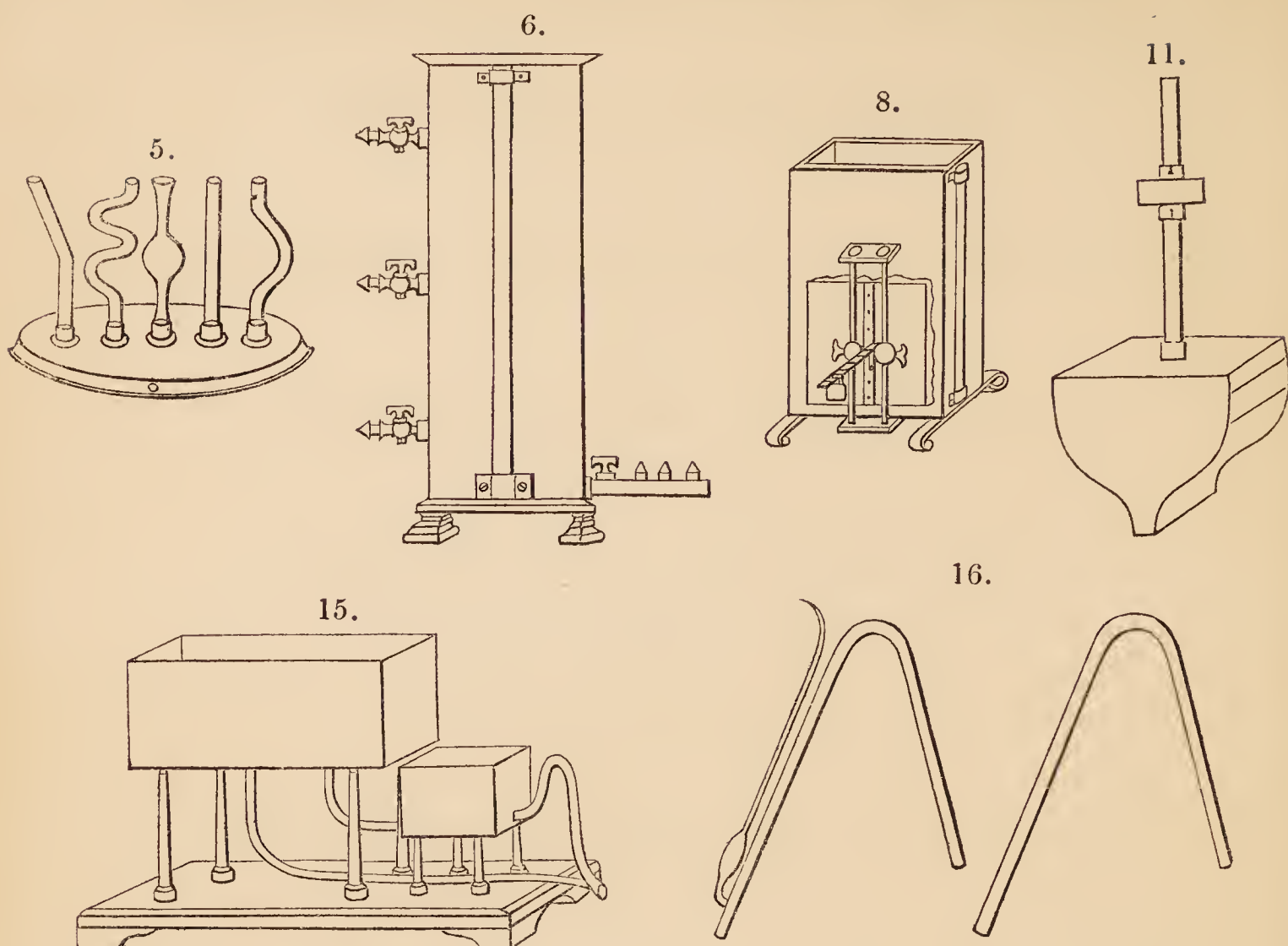
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HYDROSTATIC AND HYDRAULIC INSTRUMENTS.

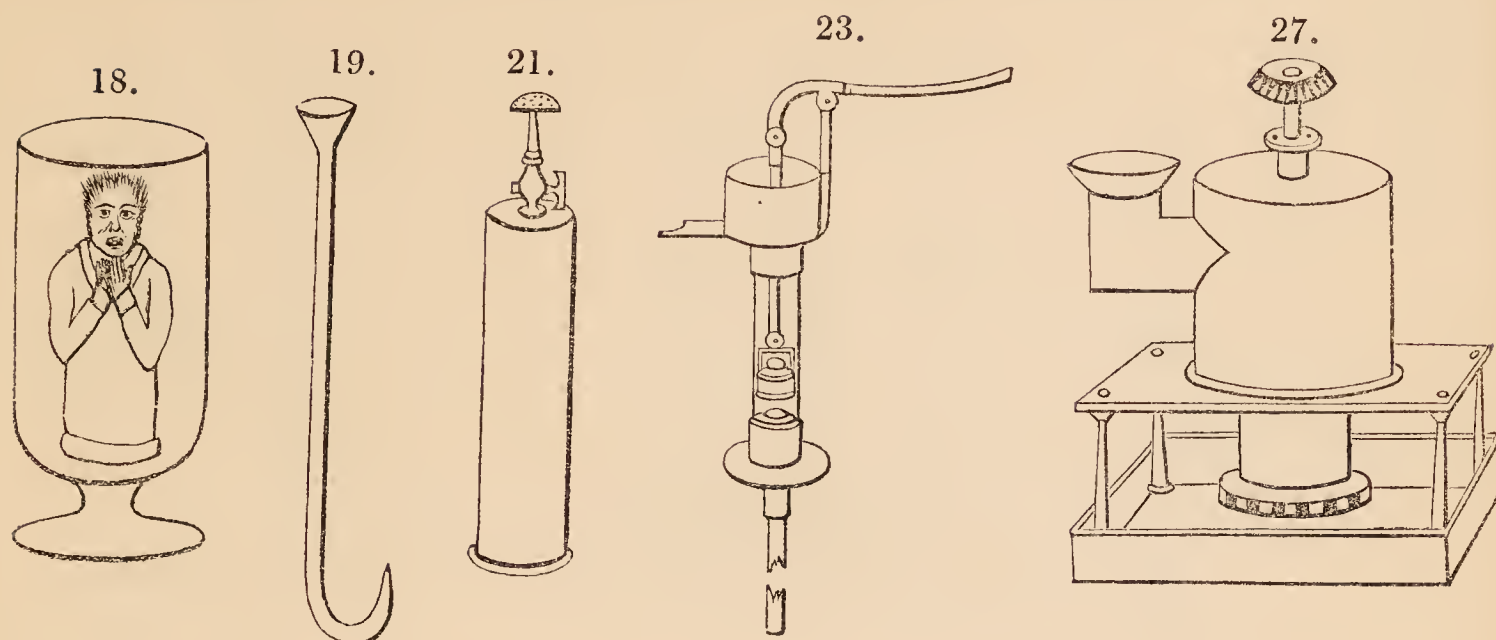


These Instruments are employed to illustrate the properties of fluids, and also that department of the science of mechanics which relates to their forces and motions.

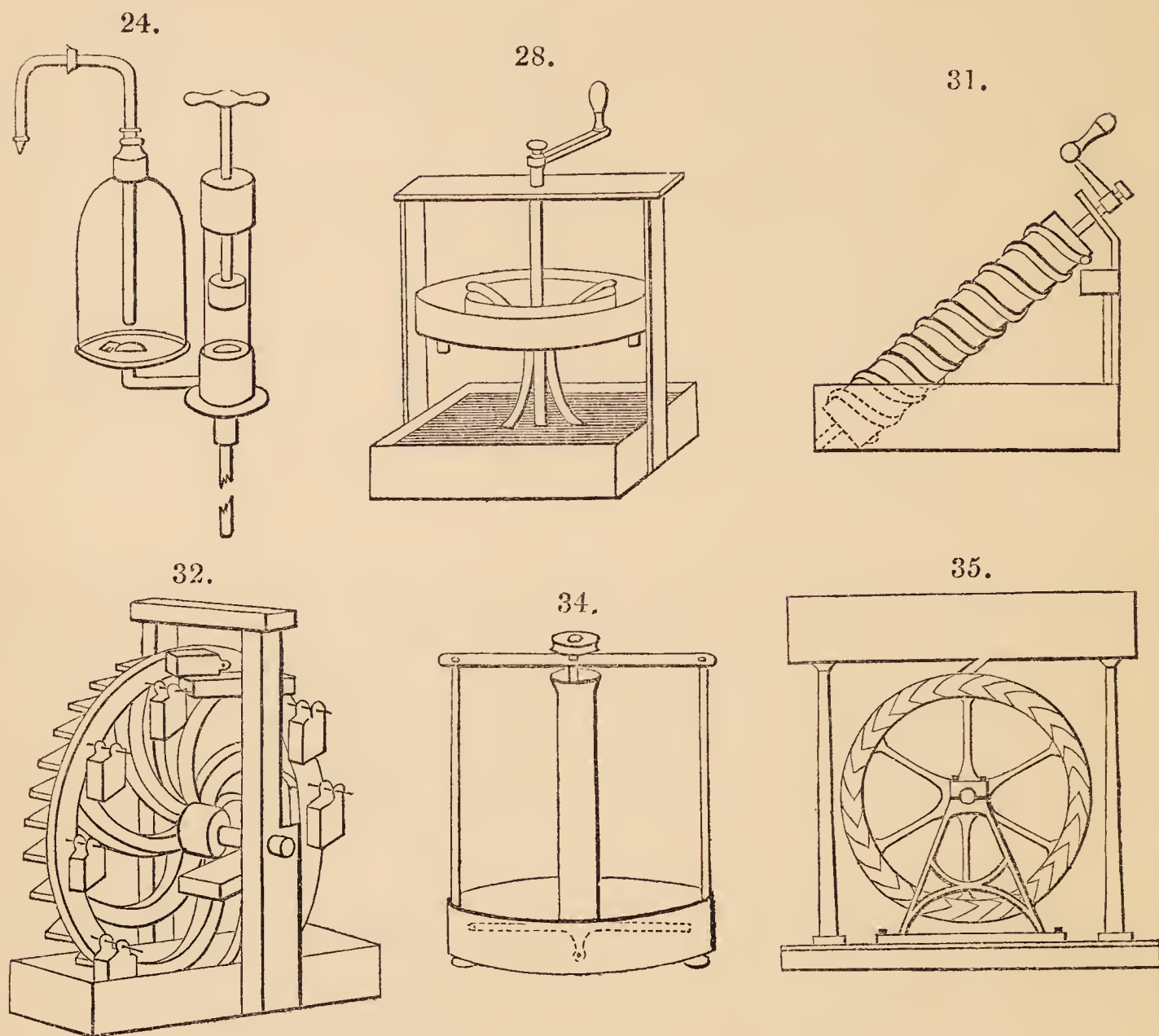
1. Hydrostatic Paradox. This apparatus consists of three large glass vessels of different forms with cemented brass rings, ground plate, lever and stand. It illustrates that when the area of the base remains the same, and the perpendicular depth of the liquid contained in the vessels equal, the pressure upon the base will be the same without regard to the form of the vessel or the relative quantity of liquids contained, £3 13s. 6d. to £7 7s.
2. Another form of apparatus for showing in however thin a column the perpendicular height of a fluid is extended, its pressure will be proportionately increased, 5s. to £1 1s.
3. Apparatus to illustrate the power of fluids to transmit pressure equally in every direction, £3 3s. to £9 9s.



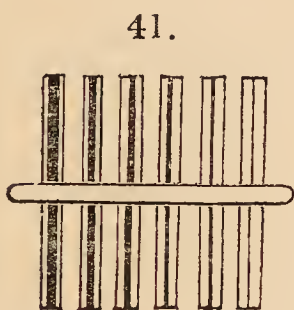
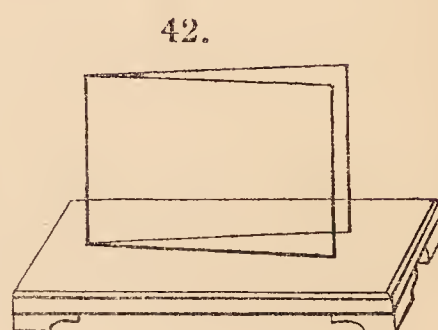
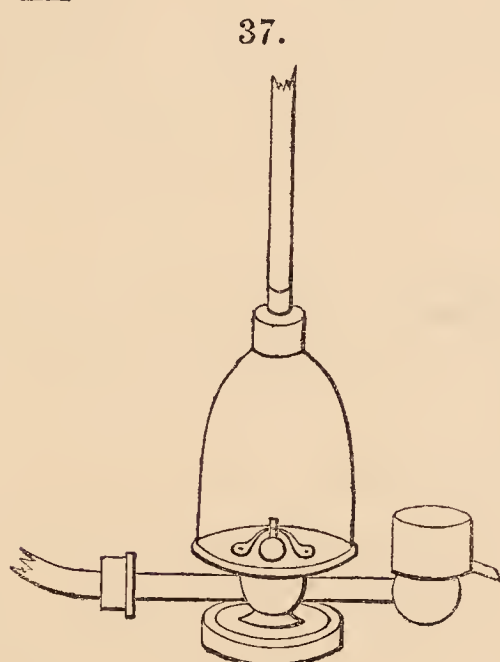
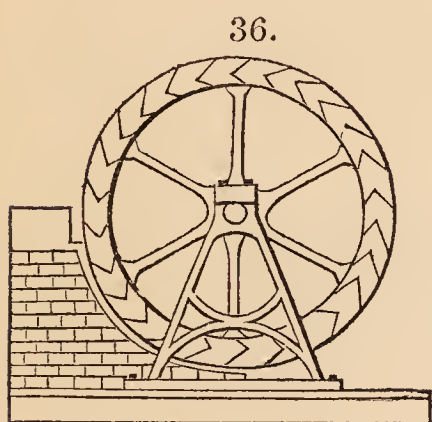
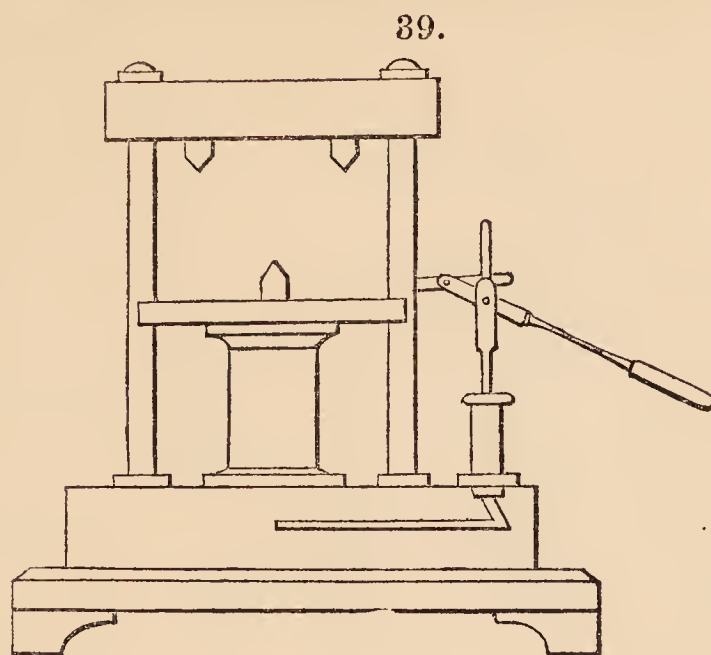
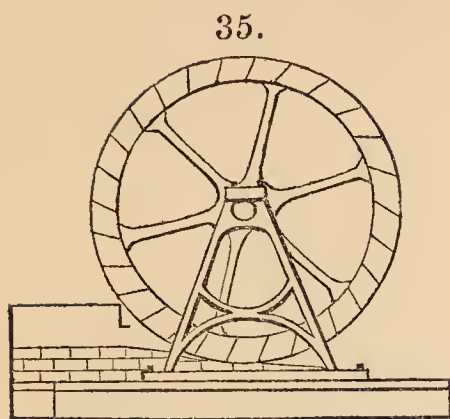
4. Hydrostatic Bellows, illustrating the two principles that fluids press equally in all directions, and in proportion to their perpendicular heights. It demonstrates that any column of water or other fluid, however small in bulk, may be made to balance and support any quantity or any weight, however great, by increasing the height of the vertical column, £1 10s., £3 3s., £5 5s., £7 7s.
5. Apparatus to illustrate the disposition of fluids to seek and maintain the same level. It consists of three or five glass vessels of various forms, having a connection with the same water-trough, £2 10s., £5 5s., £10.
6. Apparatus to illustrate the spouting or flowing of water through jets, and the effects of adjutages in streams of fluids, £2 10s., £4 4s., £6 6s.
7. Apparatus to illustrate the upward pressure of fluids, £6 6s. to £10 10s.
8. Apparatus showing the centre of pressure of a single force keeping a flood-gate shut, £6 16s. 6d., £7 17s. 6d.
9. Apparatus to illustrate the resistance of fluids on the surfaces of variously formed bodies moving through them.
10. Apparatus to exhibit the position in which fluids of different densities, such as water and mercury, will support each other, 5s. to £1 1s.
11. Apparatus consisting of a section of a ship at right angles to its length, with adjusting weight for exhibiting the properties of the metacentre or stability of floating bodies, £1 4s.
12. Apparatus to exhibit that a floating body displaces a quantity of liquid equal in weight to its own bulk, 10s. to £1 14s.
13. Apparatus to show when a solid, specifically heavier than a fluid, is immersed to a depth which is to its thickness as the specific gravity of the solid to that of the fluid, and the pressure of the fluid from above be removed, the body will be sustained in the fluid, 15s. to £1 4s.
14. Hollow metallic sphere, the weight of which is delicately adjusted, so that it will swim in cold water and sink in warm. This apparatus shows the decrease of density in fluids dependent on increase of temperature.
15. Apparatus to illustrate intermitting and reciprocating springs, consisting of reservoirs and several outlets in the form of siphons, which when filled continue to run until the reservoirs are discharged, £3 3s.



16. Siphons or bent tubes, with one branch shorter than the other, employed to decant a liquid from one vessel to another, whose surface is lower than that of the vessel to be emptied. This is effected by exhausting the siphon of the air it contains and filling it with some of the liquid to be transported: then if the short arm be immersed in the full vessel, the liquid flows through the siphon to the empty vessel, into which the long arm descends, until the surfaces are equal. In glass, pewter or brass, 1s., 2s. 6d., 4s. 6d., 7s. 6d.
17. Wirtemberg Siphon. This form of siphon, when once filled, is constantly ready for use without any previous exhaustion, at least so long as it is kept in an erect position, 2s. 6d. to 7s. 6d.
18. Tantalus Cup. This apparatus consists of a glass vessel containing a carved figure, having a siphon concealed within the body. When water is poured into the vessel even with the chin of the image, the vessel is immediately emptied by the operation of the siphon, 8s. 6d., 12s.
19. Simple form of Fountain, consisting of a glass tube turned up and contracted, so as to throw out the fluid contained in it, in a jet, which rises very nearly to the height of the fluid in the tube, 2s. 6d. to 10s.
20. Fountain at command. It consists of an air-tight vessel to receive water, supported by a large open tube. There are several small jets or spouting-pipes at the bottom, the whole placed in a basin of water. The arrangement is such that the observer by attention can state when the fountain will play or when it will cease, £1 11s. 6d. to £2 12s. 6d.
21. Artificial Fountain, which is made to act by condensed air, consists of a strong hollow vessel, pipe, stopcock, condensing syringe and a set of jets, £2 2s., £3 13s. 6d., £5 5s.
22. Hero's, or Fountain of Compression. In this machine the first reservoir is lower than the orifice of the jet; a pipe descends from it to the air-vessel, which is at some distance below, and the pressure of the air is communicated by an ascending tube to a third cavity, containing the water which supplies the jet, £2 2s. to £3 3s.
23. Working Model of Household or Lifting Pump with glass barrel. The valve through which the water escapes is placed within the piston itself, so that the same barrel serves for the ascent of the water, which rises in one continued line, while the piston is raised and rests on the fixed valve while it is depressed, 18s., £1 11s. 6d.
24. Working Model of the Forcing-Pump with glass barrel; the moveable valve is placed below the fixed valve, and introduced between the piston and the bottom of the barrel. A bell-glass air-vessel is supplied, the condensed air in which, reacting on the water, expels it more gradually and in a continual stream, so that the air-vessel has an effect analogous to that of a fly-wheel in mechanics. The instrument, having a jet-pipe, exhibits the operation of the fire-engine, £1 10s. to £3 3s.
25. Working Models of Lifting and Forcing-Pumps, mounted on the same high mahogany stand, with cisterns for supplying water, £3 3s., £5 5s.
26. Vera's Rope Pump for raising water by means of friction. It consists of a hair-rope or bundle of ropes passing over a pulley above and a pulley below, which, when made to move with a given velocity, draws up a certain quantity of water by its friction, £7 7s.
27. Working Model to illustrate the Turbine or Horizontal Water-wheel.

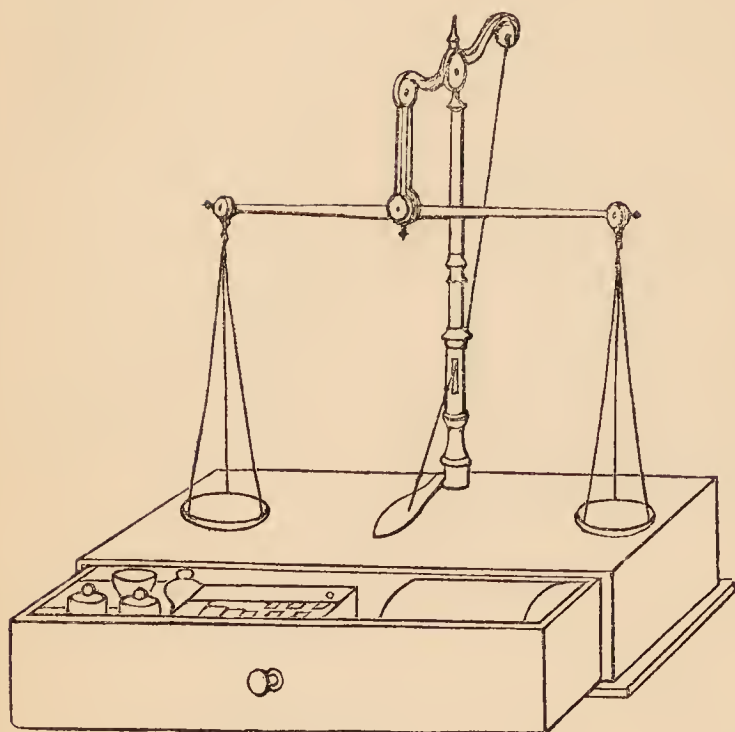


28. Working Model of the Centrifugal Pump, for raising water by means of a centrifugal force combined with the atmospheric pressure, £3 3s. to £7 7s.
29. Working Model to illustrate the Chain Pump, consisting of two collateral square barrels, and an endless chain of pistons of the same form fixed at proper distances, £8 8s.
30. Working Model of De la Hire's Pump. This machine produces the full effect of two pumps with the friction of one only, for it is a lift-and force-pump that raises an equal quantity of water by its up and down stroke, £4 4s. to £6 6s.
31. Working Model of Archimedes Screw or Water Snail, consisting of a single tube wound round a cylinder which revolves on an axis in an oblique position. This ingenious hydraulic machine is a primitive method of elevating water to small heights, £1 15s. to £5 5s.
32. Working Model to illustrate the Persian Wheel used for raising water, £3 3s. to £10 10s.
33. Working Model of Barker's Centrifugal Mill. In this machine the water does not act by its weight or momentum, but by its centrifugal force and the reaction that is produced by the flowing of the water on the point immediately behind the orifice of discharge, £2 10s. to £7 7s.
34. Overshot Water-Wheel, to the circumference of which a number of troughs are attached. When the water is introduced into the proper trough from a horizontal course, the weight of the water preponderates and the trough descends, thus placing the wheel in motion and thereby bringing another bucket to be operated upon by the stream of water, and so on, ultimately producing continued rotatory motion, whose velocity is in a great measure determined by the impetus of the stream, £2 2s., £3 3s., £5 5s., £10 10s.
35. Undershot, Tide or Stream Wheel, is furnished with a number of float-boards or plane surfaces arranged around its circumference, for the purpose of receiving the impulse of the water conveyed to the under part of the wheel, £2 2s., £3 3s., £5 5s., £10 10s.

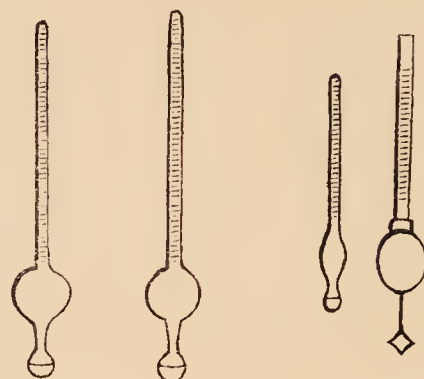


36. Breast Wheel, in which the water is delivered at an intermediate point between the upper and under part of the wheel, £2 2s., £3 3s., £5 5s., £10 10s.
37. Working Model of Montgolfier's Hydraulic Ram. In this machine, by stopping the velocity of a stream of water flowing through a long pipe, a force is obtained by which a small quantity of water may be raised to a considerable height, £5 5s., £7 7s.
38. Clepsydra, or Water Clock, employed at an early period to indicate the hours of the successive elevations of the water which entered into a vessel in quantities regulated according to the proposed division of time, £3 3s. to £5 5s.
39. Working Model of Bramah's Hydrostatic Press, in which the property of fluids for transmitting pressure equally in all directions is very successfully employed as a mechanical power to a great extent, £5 5s., £16 16s., £21.
40. Apparatus to exhibit that more water issues from a vessel through a short pipe than through a simple aperture, 12s. to £2 2s.
41. Series of Glass Tubes, with bores of different diameters for showing capillary attraction, 3s. to 7s.
42. Another form of Apparatus for showing the hyperbolic curve produced by capillary attraction. It consists of two glass plates placed at a small adjustable angle, 10s., 15s., £1 1s.
43. Apparatus consisting of a tall cylindrical glass jar containing water, a delicate hollow glass balloon or figure floating in it, and an air-tight cover to the jar. This pleasing philosophical toy illustrates most of the laws of fluidity, 7s. 6d., 15s.
44. Hydrostatic Balances with steel or brass beams, packed in neat mahogany cases, accompanied by all the requisite apparatus for determining the specific gravity of both liquid and solid bodies, £3 3s., £4 14s. 6d., £8 8s., £16 16s.
- Hydrometers for determining comparatively the specific gravity of fluids by their density. These instruments are extensively employed in commerce for ascertaining the quality of chemical and other solutions.

44.



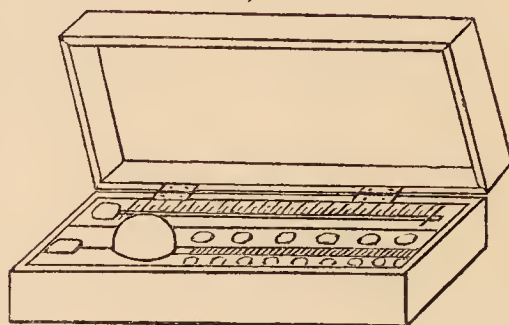
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48.



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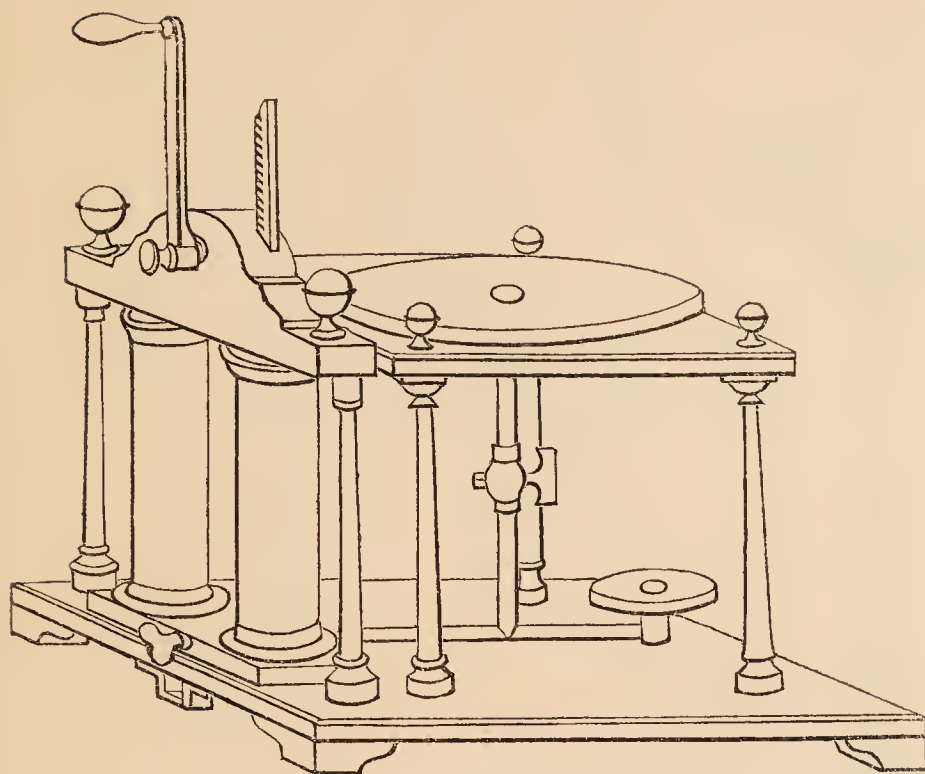
45. **Beaumé's Hydrometer.** This instrument is often employed by manufacturers for ascertaining the value of saline solutions; it is a rude instrument of its class, 5s. 6d.
46. **Sykes's Metal Hydrometer.** This instrument is employed in the Excise for determining the quantity of spirit of given specific gravity contained in a liquor of supposed unknown strength, £4 4s.
47. **Glass Hydrometer.** This instrument possesses sufficient accuracy for all common practical purposes, 7s. 6d.
48. **Hydrometrical Beads in sets.** These hollow glass beads are used for estimating the strength of spirituous liquors, 8s. to 18s.
49. **Sykes's Saccharometer in metal.** This instrument is used by brewers for measuring the strength of wort upon the principle of the hydrometer, £5 5s.
50. **Sykes's Saccharometer in glass,** 7s. 6d.
51. **Cooper's Glass Hydrometer for Acids,** in a case, £1 1s.
52. **Prout's Gravimeter, or Urinometer,** in metal, for ascertaining the specific gravity of the urine in diabetes and other diseases, in morocco case, £1 1s.
53. **Prout's Gravimeter, or Urinometer,** in metal, with thermometer, test glass and tubes, in morocco case, £1 15s.
54. **Prout's Gravimeter, or Urinometer,** in glass, with thermometer, test glass and tubes, in morocco case, 16s. 6d.
55. **Prout's Gravimeter, or Urinometer,** in glass, with case, 5s. 6d.
56. **Hydrometer, or Lactometer** for estimating the relative values of different milks, 7s. 6d.
57. **Nicholson's Gravimeter.** This instrument determines the specific weight of both solids and fluids in an easy and expeditious way, £1 11s. 6d., £3 13s. 6d., £5 5s.

PNEUMATIC INSTRUMENTS.

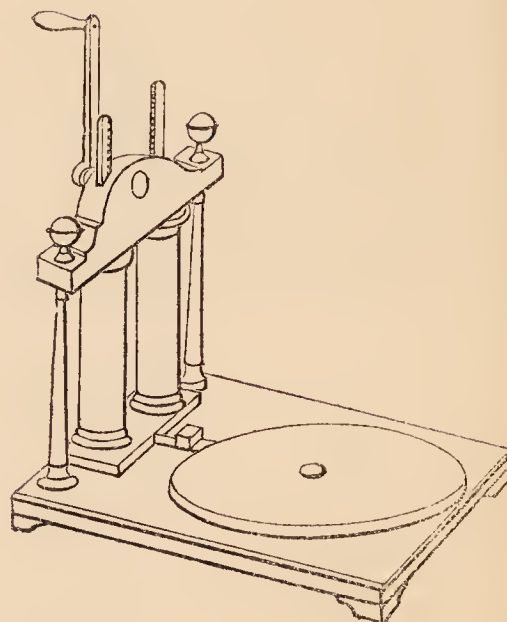
The general intention of Instruments thus denominated is for the experimental illustration of the doctrine of elastic fluids, but more particularly the mechanical properties of air.

58. **Very best large Double Cylinder Air-Pump,** with a Smeaton's Single Cylinder Pump in addition. This combined arrangement affords the best and most rapid exhaustion that can be effected, £60.—See frontispiece.
59. **Best large size Double Cylinder Air-Pump,** complete, with high mahogany stand, barometer and siphon, gauges, &c., £35.—See frontispiece.
60. **Smeaton's large Single Barrel Air-Pump,** on high mahogany stand, with barometer and siphon, gauges, &c. This pump produces a very excellent exhaustion, and is decidedly a good instrument, £35.

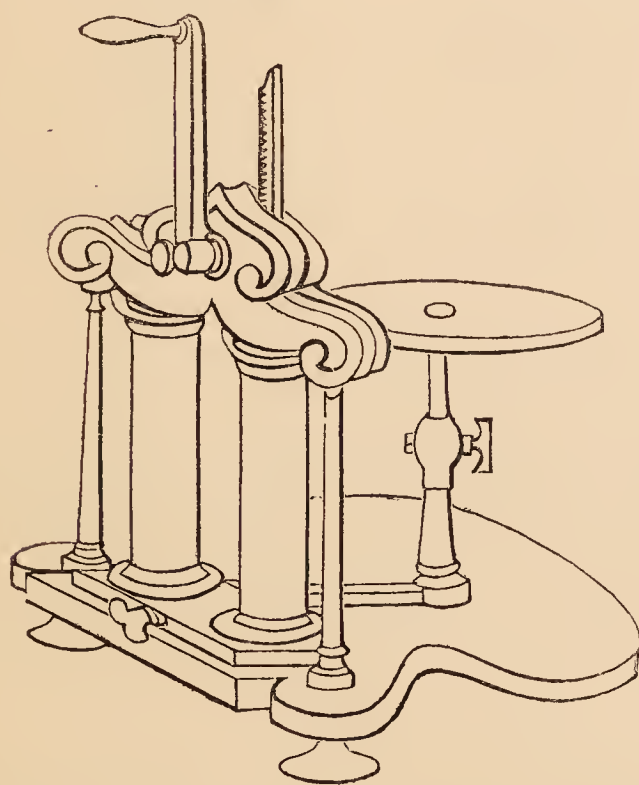
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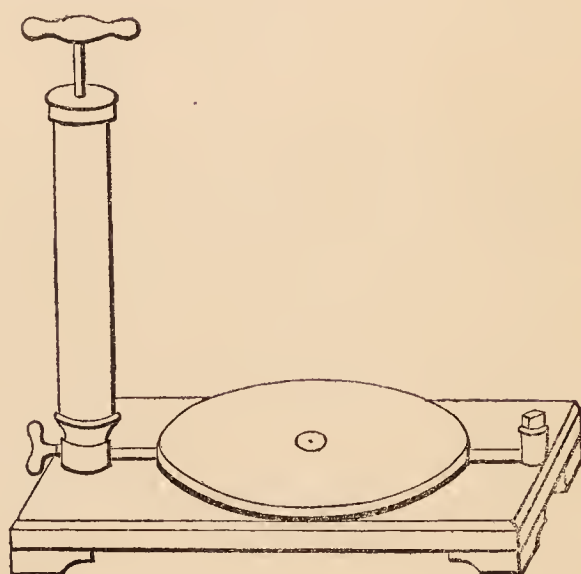
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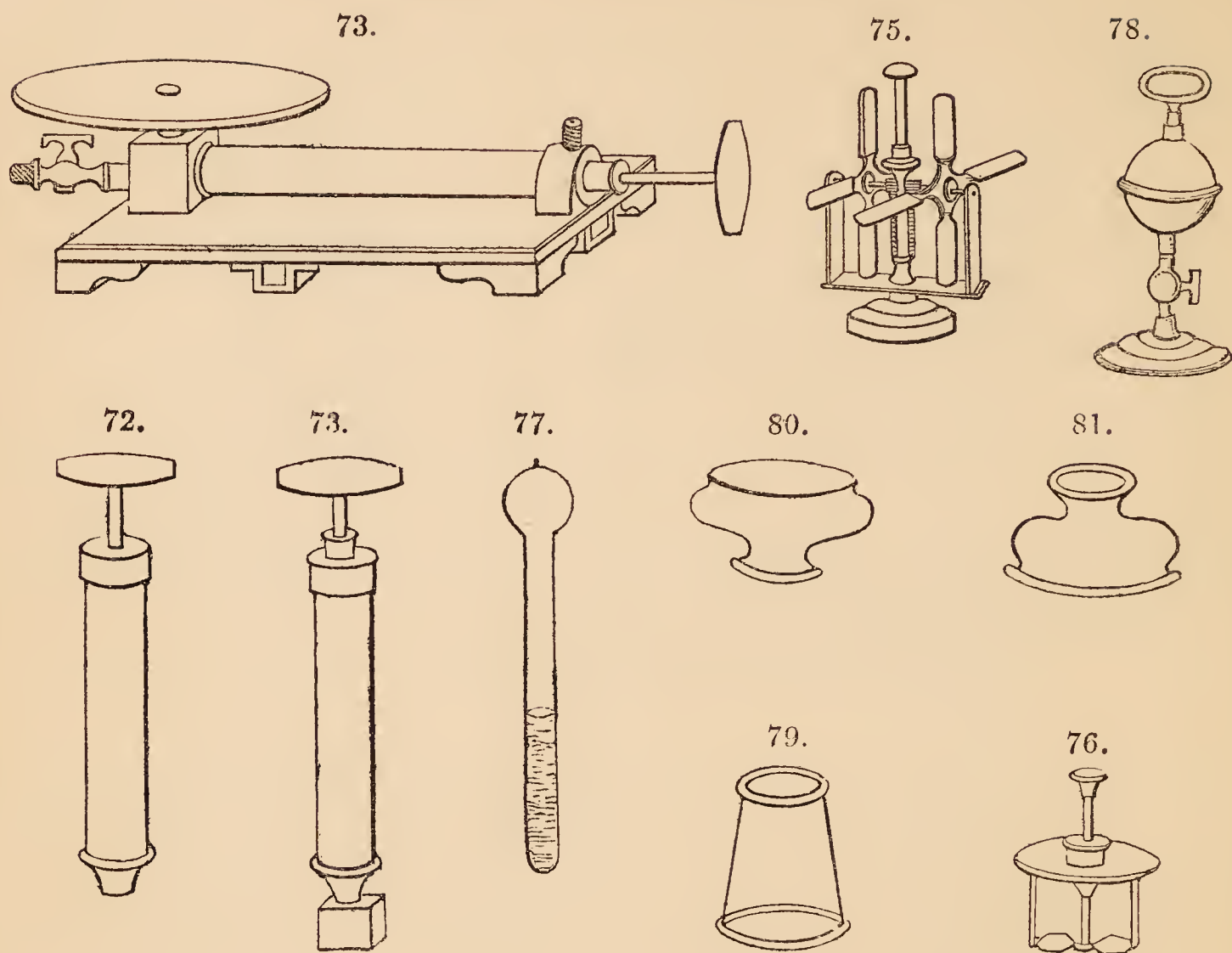
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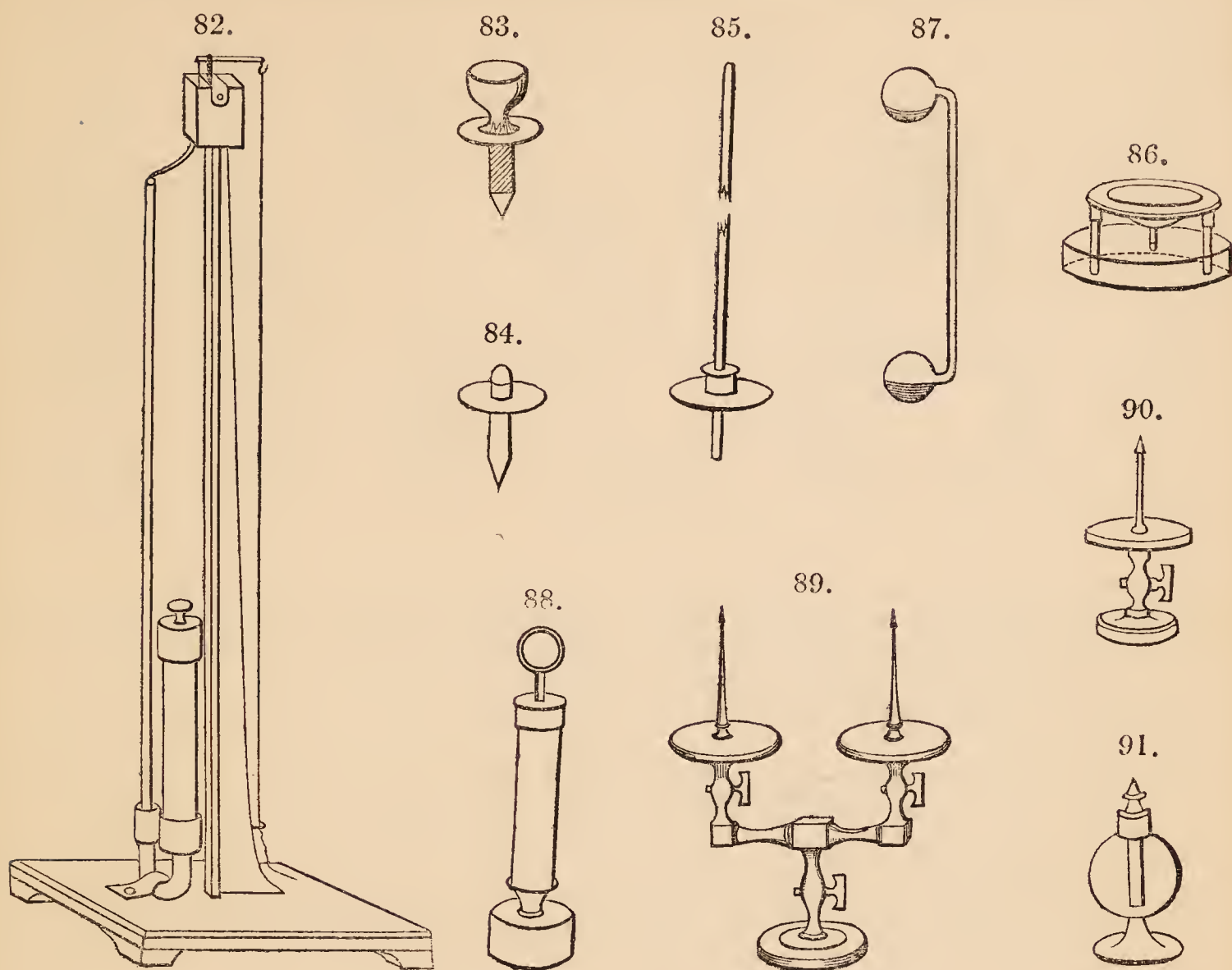
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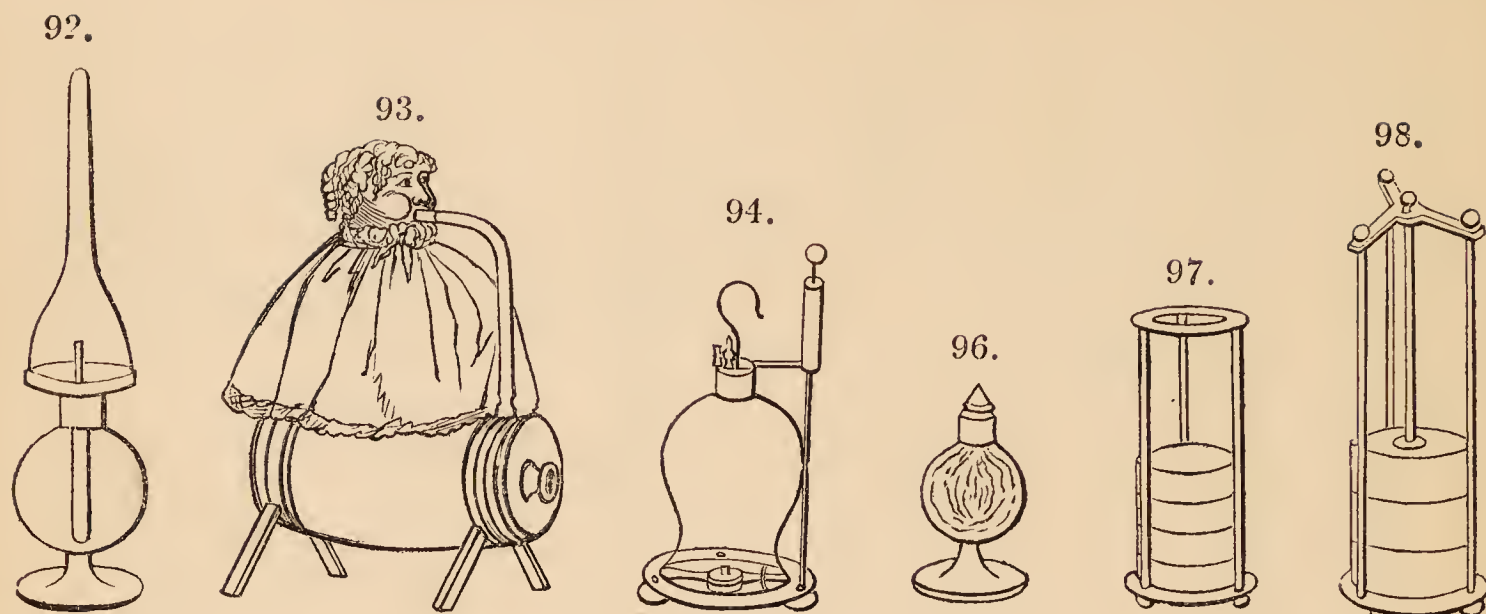
61. Large size Single Barrel Air-Pump, worked with a sector and lever, mounted on high mahogany stand, with barometer, gauge, &c., £12 12s., £15 15s.
62. Large Double Cylinder Air-Pump, with stage and elevated receiver plate, mounted, with barometer and siphon gauges, on mahogany frame to stand on the ground, £18 18s.
63. Large Double Cylinder Table Air-Pump, with stage and elevated receiver plate, siphon, mercurial gauge, clamps and key, &c., £15 15s.
64. Large Double Cylinder Table Air-Pump, with elevated receiver plate on brass pillar, siphon, mercurial gauge, &c., £12 12s.
65. Middle size Double Cylinder Table Air-Pump, with stage and elevated receiver plate, siphon, mercurial gauge, clamp and key, &c., £10 10s.
66. Small size Double Cylinder Table Air-Pump, with elevated receiver plate on brass pillar, siphon, mercurial gauge, clamp and key, &c., £8 18s. 6d.
67. Middle size Double Cylinder Table Air-Pump, with elevated receiver plate, siphon, mercurial gauge, &c., £7 17s. 6d.
68. Small size Double Cylinder Table Air-Pump, with elevated receiver plate, siphon, mercurial gauge, &c., £4 14s. 6d.



69. Single Cylinder Table Air-Pump, elevated receiver plate, siphon, mercurial gauge, clamp and key, &c., £1 5s., £2 12s. 6d.
70. Single Cylinder Table Air-Pump, which can be employed either for exhausting or condensing. The cylinder is placed horizontally with an elevated receiver plate, siphon, gauge, two clamps and key, £4 14s. 6d. If fitted with a barometer vacuum gauge, £5 15s. 6d.
71. Small Single Cylinder Table Air-Pump, with an assortment of apparatus, the whole packed in a case. The air-pump and apparatus will enable the young student to perform all the most illustrative experiments on the mechanical properties of air, £5 5s.
72. Exhausting Syringe, in principle the same as the air-pump, and very convenient for exhausting air from small vessels, 7s., 12s., 18s.
73. Condensing Syringe for forcing extra quantities of air into vessels, 7s., 12s., 18s.
74. Exhausting and Condensing Syringe in one apparatus, for the purpose of exhausting from or condensing into vessels, with the additional power of transferring any gaseous fluid from one vessel to another, 12s., 18s. to £1 11s. 6d.
75. Set of two Mills. This apparatus consists of two separate axles with four thin vanes of equal length, breadth and weight on each. One set of vanes have their planes at right angles to their axle; the plane of the other set is parallel to their axle, £1 14s. to £2 2s.
76. Guinea and Feather Apparatus for proving the resistance of air diminishes the velocity of falling bodies, the diminution being greater or less according to the density of the moving mass, as the experiment shows that in a vacuum light and heavy bodies descend in equal times, 10s., 15s., £1 1s., £1 10s.
77. Philosophical Water Hammer. This instrument shows the fall of a liquid on a solid, or one liquid on another, in a non-resisting medium, and produces a sharp noise, similar to that heard on the collision of hard bodies in air, 3s. 6d., 5s., 7s. 6d.
78. Magdeburg Hemispheres, consisting of two hollow half globes of brass, ground and fitted to each other, so that their rims when touching are air-tight; the lower one has a stopcock attached for convenience in exhausting. This apparatus is illustrative that the pressure of the air nearly equals 15 lbs. for every square inch of surface, 12s., 14s., 18s., £1 5s., £2 2s.

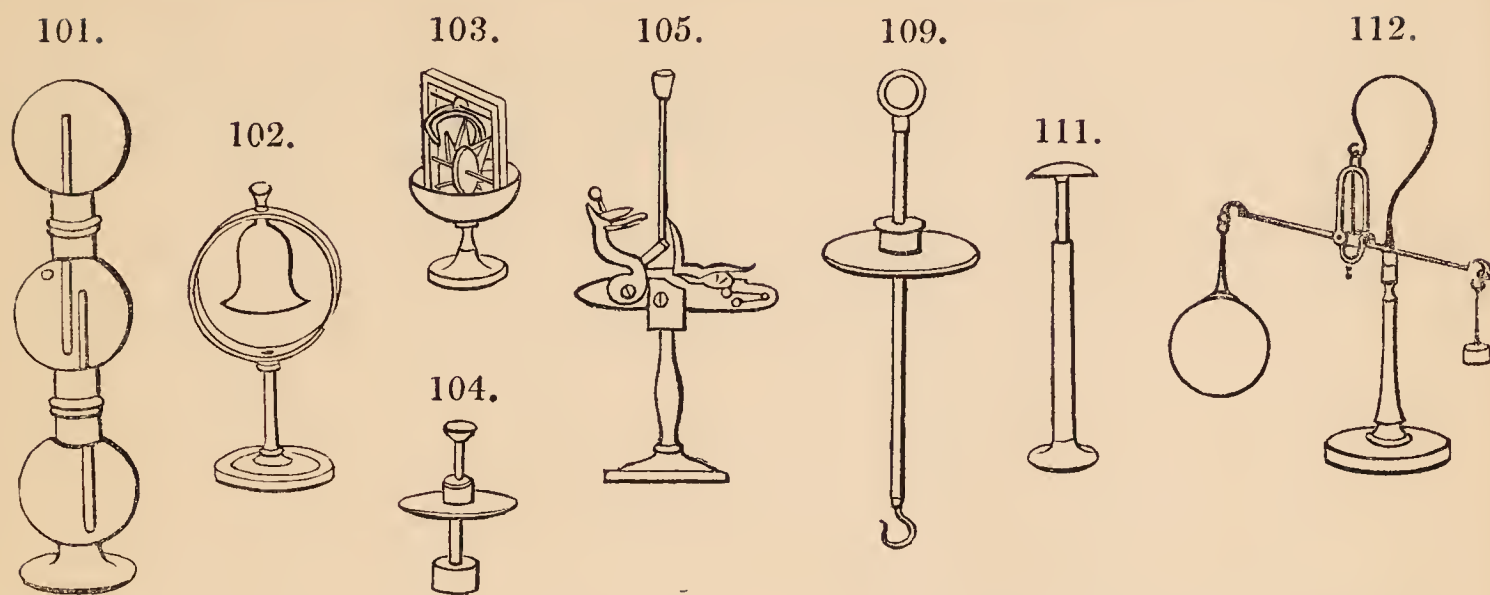


79. Hand Glass to show the pressure of the air. When the hand is applied above the glass and the internal air removed, the pressure of the external air is sensibly felt by the hand being pressed down as if by a great weight, 2s. 6d. to 4s.
80. Bladder Glass. This piece of apparatus illustrates the pressure of the air in a manner similar to the foregoing experiment. When a piece of bladder is tied on the top of the glass and dried, upon the air being withdrawn from the interior of the glass, the strength of the bladder is overcome by the pressure of the external air and bursts with a loud report, 2s. 6d. to 4s.
81. Combined Hand and Bladder Glass, adapted either for showing the pressure holding the hand down, or bursting the bladder, 3s. 6d.
82. Marriotte's Experiment for showing that the elasticity of air varies with the density, £8 8s.
83. Wood Mercurial Filtering Cup, with flat ground brass plate to place on the top of a glass receiver. This piece of apparatus illustrates the porosity of hard wood, as mercury placed in the cup may be forced through the pores of the wood in the form of a beautiful silvery shower by the pressure of the external air when the internal air is removed by the air-pump, 5s. 6d., 7s. 6d., 10s. 6d., 15s.
84. Cylindrical piece of wood with flat ground brass plate to place on the top of a glass receiver. The porosity of wood is illustrated by this apparatus, when the lower end of the cylinder dips into a jar of water inside the exhausted receiver, while the upper end remains in the air, 4s. 6d., 6s. 6d., 10s. 6d.
85. Torricelli's experiment to illustrate that the mercury in barometer tubes is supported by the pressure of the air on its surface in the cistern in which the open ends of the tubes are placed; and that the more dense and heavy the atmosphere is, the higher does the mercury rise; and, on the contrary, the thinner and lighter the atmosphere is, the more will the mercury fall, 12s., 15s., 18s.
86. Leslie's Apparatus for freezing water under diminished pressure. It consists of a large glass hemispherical receiver, a broad, flat glass dish for sulphuric acid, a shallow pan of glass or porous earthenware for holding the water exposed to congelation, and a metallic

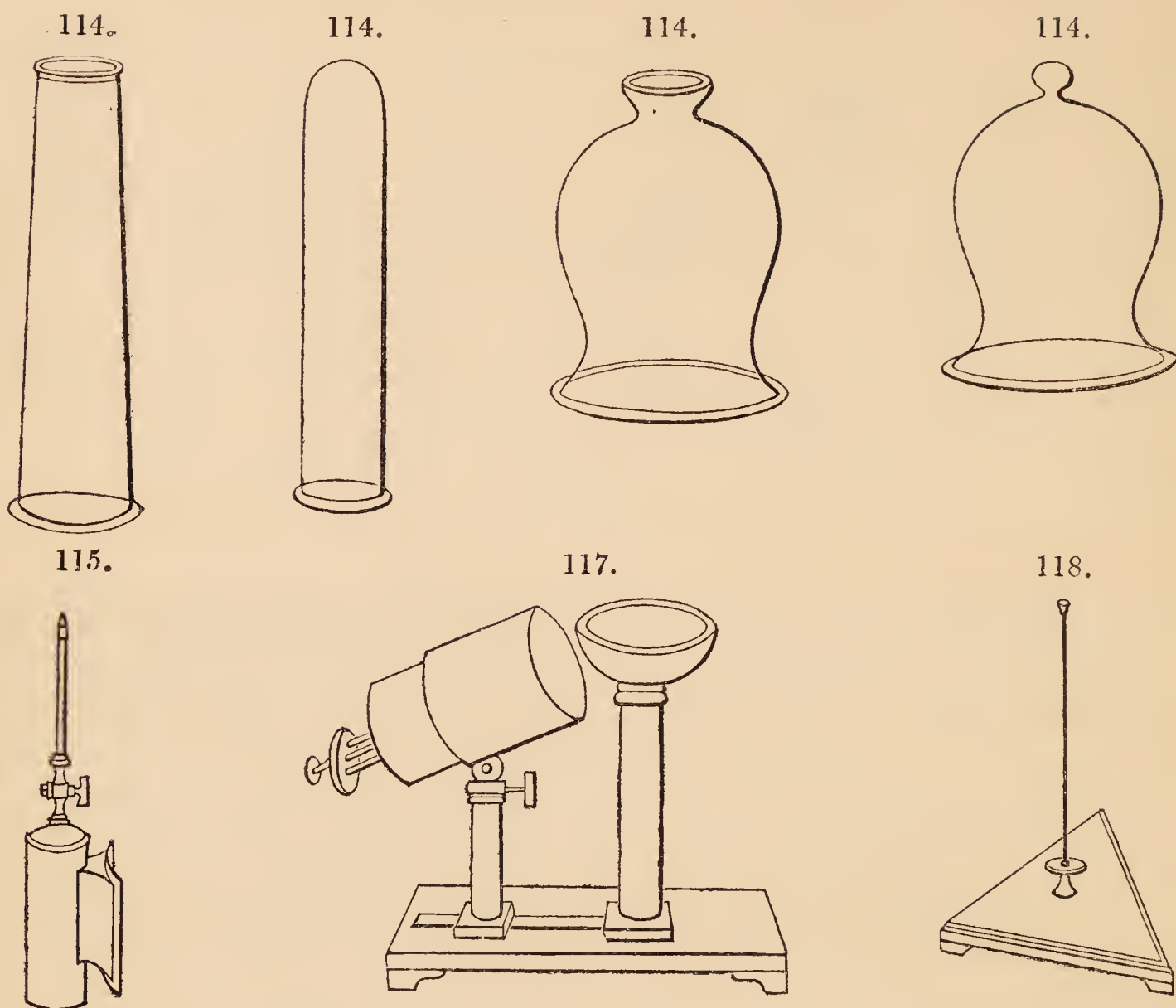


ring with glass legs to support the pan. A thin film of ice may be formed in the hottest weather with this apparatus, so rapid is the evaporation from the surface of the water under the exhausted receiver, 12s., 18s., £1 5s.

87. Wollaston's Cryophorus, consisting of a simple glass tube with a glass bulb at each extremity, 4s., 6s. 6d., 10s.
88. Solid Piston Syringe, with a heavy leaden weight affixed to the bottom. If the weight be drawn down in the open air, it will be forcibly driven back by the upward pressure of the air; but in vacuo, where the pressure is removed, it will descend. The syringe is suspended under a receiver in the experiment, 7s. 6d., 10s. 6d., 15s.
89. Double Transfer Plates with connecting pipes and three stopcocks. This piece of apparatus (with glass receivers placed on the plates) illustrates the expansibility of air. When the air has been exhausted from one receiver and a communication opened with the other, both receivers are held down with equal force on their respective plates, showing that a force equal to half the elastic force of the common air acts against the whole pressure of the external air upon their outsides, £1 15s. to £3 3s.
90. Single Transfer Plate with jet-pipe and stopcock. This piece of apparatus shows the pressure of air of common density, by placing a tall glass receiver on the plate and extracting the air from it. When this is done, and the stopcock placed under water, upon again opening the cock the water is pressed up the jet-pipe, and forms a beautiful artificial fountain within the receiver, 10s. 6d., 15s., 18s.
91. Artificial Fountain produced by the elasticity of air. It consists of a vessel to be partly filled with a tube reaching nearly to the bottom. When under the receiver, and the air exhausted, the spring of the confined air on the water forces it up in a pleasing jet, 3s. 6d., 5s. 6d., 9s.
92. Improved Artificial Fountain. In principle this apparatus is the same as the preceding, but here the water projected is received in a glass cover, and thus prevented from falling on the air-pump plate: a small orifice is drilled in the side of this cover to permit the escape of the air from it when under the receiver of the air-pump, 12s. to 18s.
93. Bacchus Experiment. Elasticity of air is the illustration afforded by this experiment, £1 10s., £1 16s.
94. Glass Model of the Diving Bell, loaded at the bottom sufficiently to sink it. A condensing syringe is furnished for supplying fresh portions of air under the bell, likewise a stopcock as an outlet of impure air. Painted wooden figures are supplied, and a burning spirit-lamp may be inserted under the bell, £1 5s., £2 2s., £3 3s., £5 5s.
95. Glass Flasks, mounted with brass cap and minute stopcock, for illustrating the influence of diminished pressure in facilitating ebullition; it may also be employed for weighing air or any other gaseous fluid, 7s. 6d.
96. Glass with Bladder, commonly called the Lungs' Glass, to illustrate the elasticity of air. When the air is partially withdrawn from the bladder, the spring of the confined air surrounding it in the glass compresses the bladder; on re-admitting the air the bladder expands, and the motions of the bladder have been supposed to assimilate with the action of the lungs, 3s. 6d., 5s. 6d.



97. Brass Frame with three pillars and partially blown bladder, covered with several heavy leaden weights. The elasticity of the confined air in the bladder gradually raises the weights when the air's pressure is removed from them; but on re-admitting the air, the bladder shrinks to its original bulk and the weights descend, 7s. 6d., 9s., 15s.
98. Lead Weight Apparatus of an improved form for illustrating the experiment to a large class, 18s.
99. Brass Stand for supporting under receivers shrivelled apples and other fruit, to show that they swell and appear plump in a vacuum by the expansion of the air confined in their cavities, 3s. 6d., 4s. 6d.
100. Six Thin Square Glass Phials with wire cage. This apparatus illustrates the expansive powers and pressure of the air. They are broken either by the expansion of the air confined within them, or when exhausted by the pressure of the outward air upon them, 15s. 6d.
101. Glass Apparatus for transferring a coloured liquid from one receiver to another by the mechanical properties of air. The liquid is forced in the first part of the experiment from its original receiver to the second by the elastic force of air, and from the second to the third by the pressure of air, 13s. to £1 5s.
102. Bell Apparatus for showing that air is a medium of sound, 5s. 6d., 8s. 6d., 15s., £1 11s. 6d.
103. Superior Bell Apparatus, which can be suspended in the receiver and set in action by elevating and depressing alternately the wire that passes through a collar of leathers, showing in a distinct manner that sound cannot be transmitted in a vacuum, £1 1s.
104. Gunpowder Apparatus. Another illustration that air is a medium of sound, 10s. 6d., £1 1s.
105. Apparatus for striking flint and steel under an exhausted receiver, proving the non-existence of fire without air, £1 1s.
106. Small Brass Stick for sustaining a burning taper within a glass receiver. This simple piece of apparatus shows that a constant supply of fresh air is necessary to feed the flame, 3s. 6d., 4s. 6d.
107. Apparatus exhibiting in a simple manner Clement's experiment, in which air, gas or steam issuing with force from an aperture in a flat surface did not blow away a flat plate, but rather caused its adhesion, 5s.
108. Two Brass Tubes, one cylindrical and one conical, 8s. 6d.
109. Apparatus consisting of a Ground Brass Plate for placing on receivers, with a steel wire sliding in a box containing a collar of leathers, applicable to many experiments, 7s., 9s. 6d., 12s., 15s., 18s.
110. Balloons of different materials and sizes. On inflating these balloons with hydrogen gas, they readily ascend in a room, and illustrate in a pleasing and familiar manner the principles of aërostation, 1s. 6d., 2s., 3s., 4s. to 15s.
111. Fire Syringe for producing fire by the rapid condensation of air confined in a tube. With this instrument the fact is demonstrated by the ignition of amadou, 5s., 7s. 6d., 10s. 6d.
112. Brass Stand and Balance Beam, with a piece of cork or thin hollow glass globe suspended at one end, and a counterpoise of metal at the other. This apparatus shows that two bodies of different specific gravities, which are in equilibrium in air of common density, will not be so in vacuum, 10s.

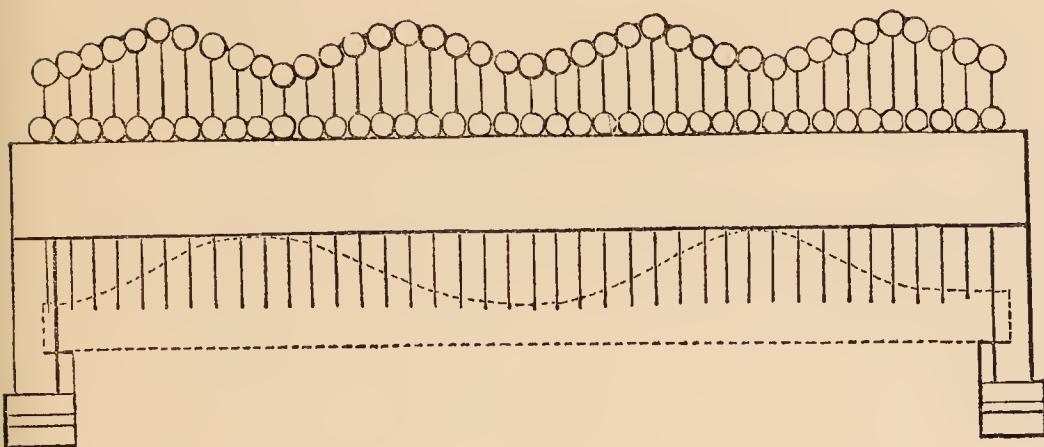


113. Brass Ground Plate, Stopcock and bent Metallic Pipe for experiments with foul air. The plate being placed on the top of an open receiver, while the end of the pipe is introduced into a charcoal fire or other deleterious air, the receiver becomes charged with such foul air, that when a small taper is inserted in it the light is extinguished, 12s., 15s.
114. Glass Receivers with ground edges, of all descriptions and sizes necessary for pneumatical experiments.
 Open Receivers, 3s. 6d., 6s. 6d., 17s., £2 2s.
 Closed Receivers, 3s., 6s., 11s. 6d., £1 18s.
 Tall Glass Receivers for guinea and feather apparatus, 4s., 9s., £1 11s. 6d.
 Tall Glass Receivers for fountain experiment, 3s. 6d., 10s. 6d.
115. Fire-cloud Fountain, for the purpose of projecting a solution prepared with spirit of wine on to the ceiling of a darkened room, on applying a light to which a very beautiful effect is produced by the variegated colours of the flames. The apparatus consists of a strong copper vessel, with lever handle, stopcock, jet, condensing syringe, &c., £6 6s.

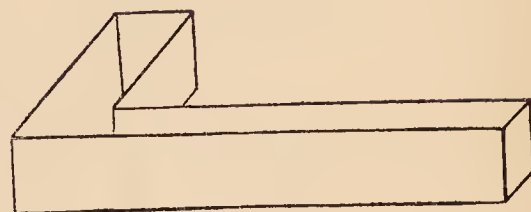
ACOUSTICAL INSTRUMENTS.

116. A Bell with hammer attached to a common pendulum escapement for ringing in the exhausted receiver of an air-pump, to show the influence of the atmosphere in conducting sound, and the conductivity of different gases with which the receiver may be filled, £1 1s.
117. Apparatus with Sliding Tube to increase the sound of bell, £2 12s. 6d.
118. Wheatstone's Kaleidophone for proving by experiment the principle of the superposition of small motions. For this purpose silvered beads are fixed on steel wires fastened into a mahogany stand by a brass clamping-screw. When the wires are thrown into vibration, a point of light reflected from the beads is seen to describe a variety of beautiful circular and elliptic epicycloidal curves, 10s. 6d., £1 1s., £1 11s. 6d.

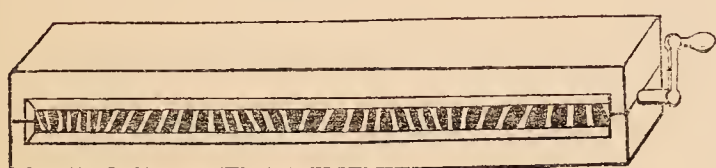
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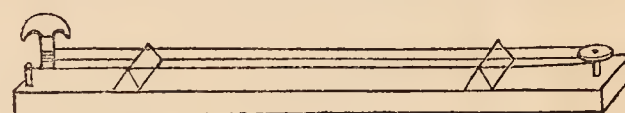
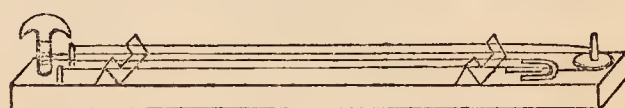
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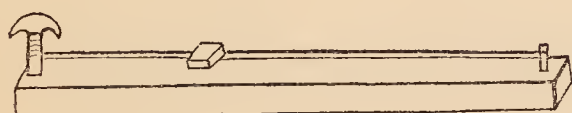
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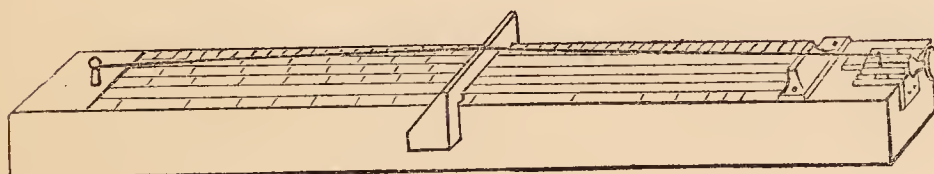
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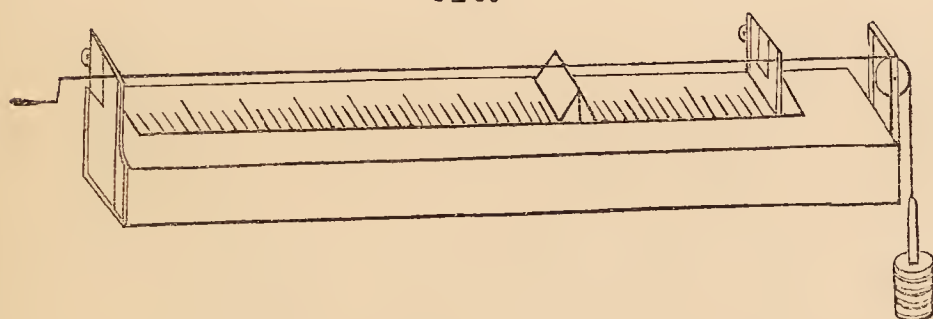
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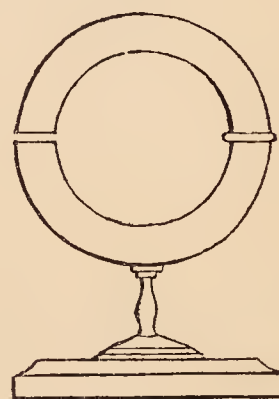
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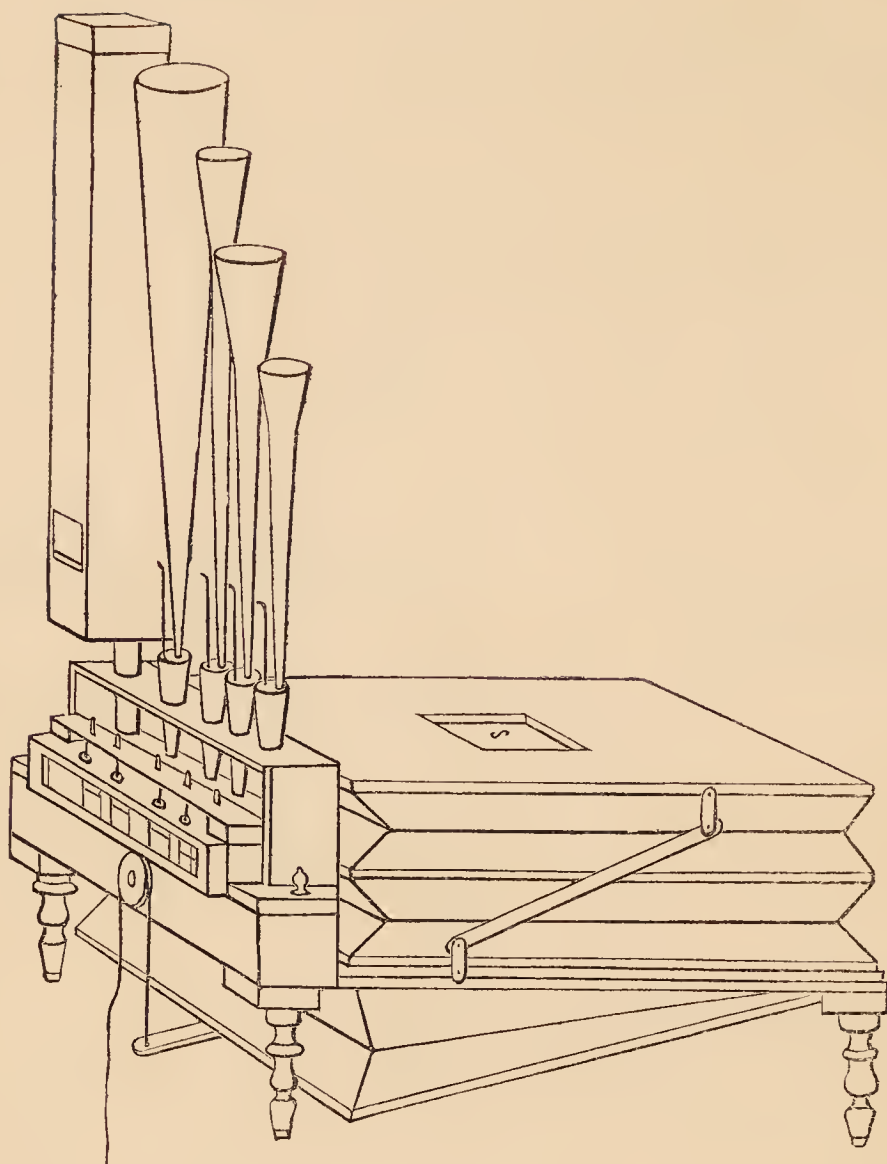


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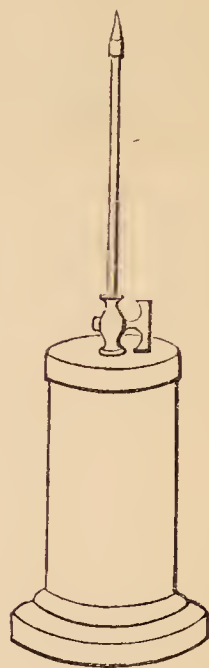


119. Apparatus to illustrate normal or transverse undulations in a row of particles; also to show the composition of different modes of undulation. This is a modification of Dr. Young's Harmonic Sliders. Accompanying the last is a set of wave curves cut in wood, the lengths of the waves corresponding to the different musical intervals; by these may be explained the nature of beats and grave Harmonics, £4 14s. 6d.
120. Apparatus to illustrate progressive and stationary longitudinal undulations in a row of particles, consisting of two series of curves drawn on a revolving cylinder, £3 13s. 6d.
121. Mahogany Trough, consisting of two portions at right angles to each other, to show the propagation and reflexion of a wave and the conversion of progressive into stationary undulations, £1 1s., £2 2s., £3 3s.
122. Elastic Spring Wire to show the harmonic subdivisions of a vibrating chord.
123. The Monochord, for showing the relation and subdivision of musical sounds, £2 2s., £3 3s., £5 5s.
124. Monochord with transferable weights to regulate the tension of a chord, £5 5s., £7 7s.
125. Apparatus for illustrating subordinate sounds or harmonics with a single string, with sliding weight, 10s. 6d., 15s.
126. Brooke's Apparatus to show the relation between the tension of a chord and the time of vibration, £1 18s., £2 5s.

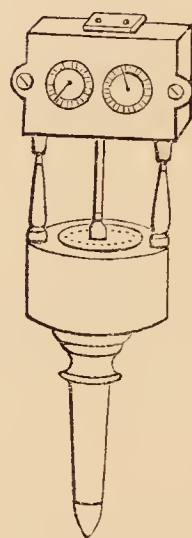
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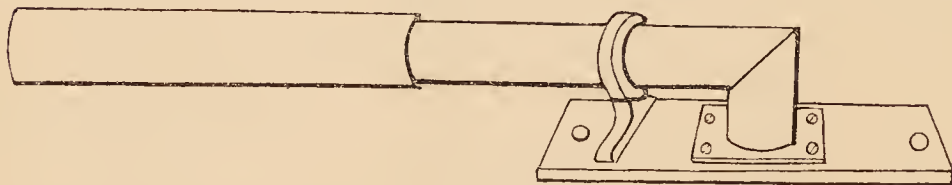
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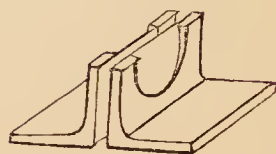
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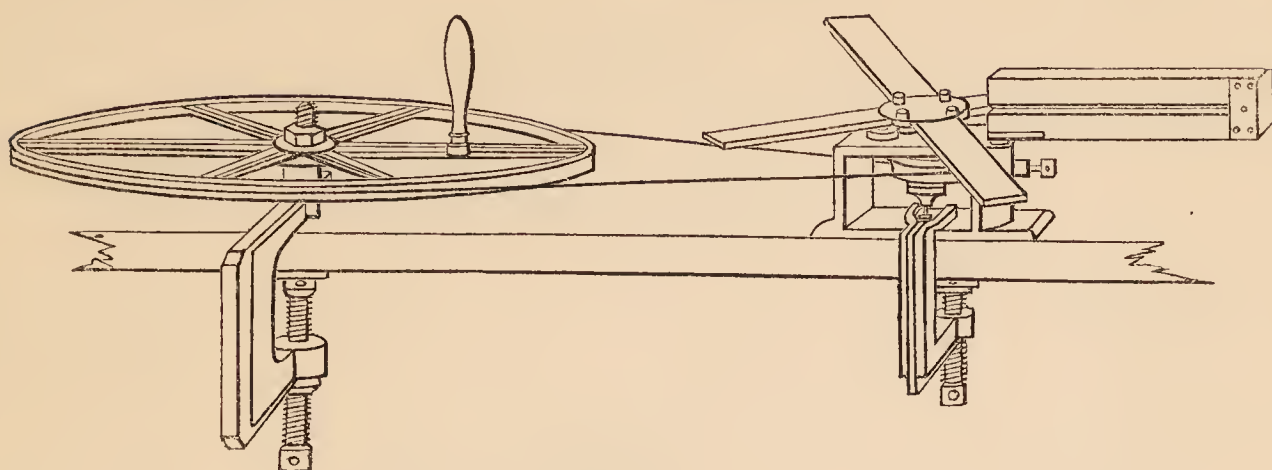


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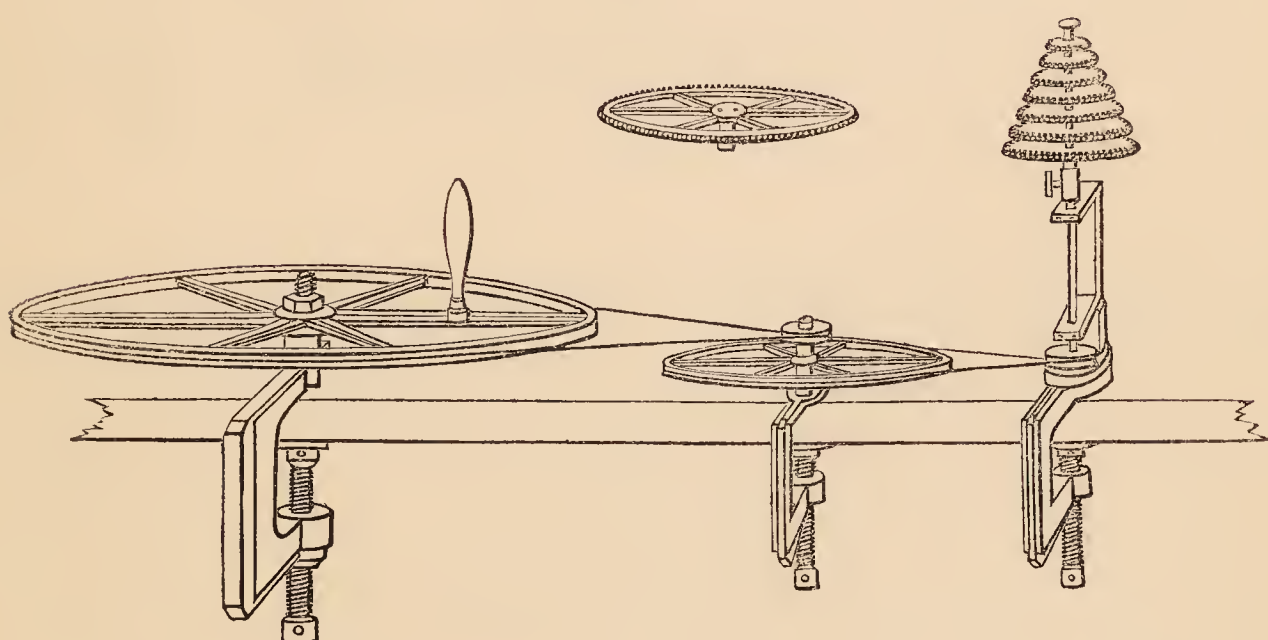


127. Biot's Apparatus for obtaining a grave harmonic from a single string. This consists of a chord stretched between two bridges, and having another bridge placed under its middle point, and so near as to be struck by the chord at each vibration; this will produce a note a fifth below the natural note of the chord, 15s., £1 1s.
128. A Long Tube with a Piston, for experiments on the reciprocation of sound and on multiple resonance, which experiments also require a tuning-fork with a small disc of metal attached to one or both sides, and a jew's harp, £1 5s., £2 2s.
129. Wheatstone's Apparatus for proving the simple mode of vibration of a tube open at both ends. This consists of an annular tube, the two halves of which are so jointed together as to have motion in the direction of a transverse section of the tube; and a square plate of glass, the lowest sound of which corresponds to the lowest sound of the tube. If a vibrating corner of the plate is placed between the open ends of the tube, little or no resonance takes place, as the impulses on the ends of the tube being always in opposite directions, neutralize each other; if, on the contrary, the ends of the tube are separated and the adjacent corners of the vibrating plate placed opposite to them, an audible resonance is immediately produced, £1 11s. 6d.
130. Hydrogen Gas Generator, with a long vertical jet, to exhibit the sounds produced in a glass tube by a flame of hydrogen, 7s. 6d., 10s. 6d., 15s.

136.

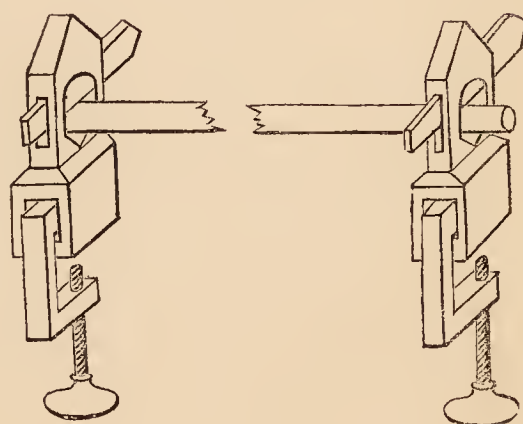
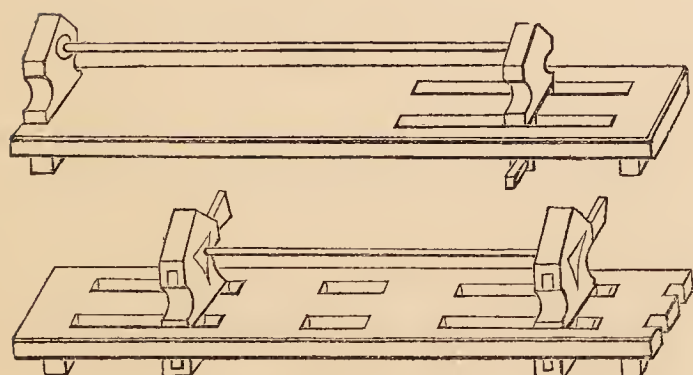


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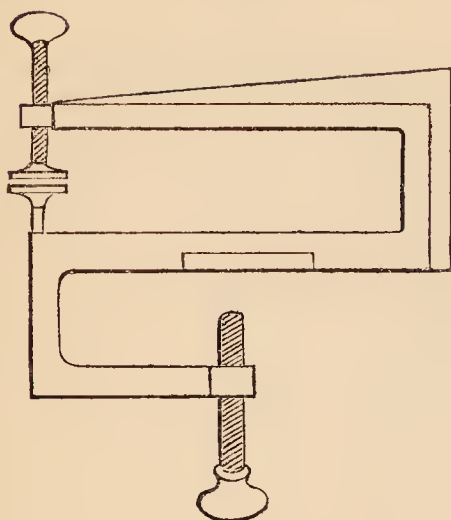
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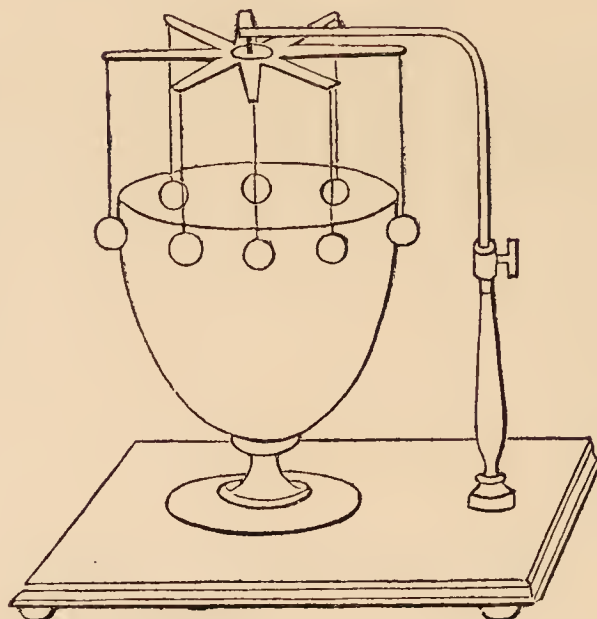


131. Horizontal Bellows with double riser, wind chest and sound board, with a set of wood pipes and metal tongued pipes, £7 17s. 6d.
132. The Syrene, to show the production of a musical sound by a succession of regular impulses, £3 13s. 6d., £4 4s.
133. Willis's Tube for the production of vowel sounds, adapted for using with the bellows, £2 2s., £3 3s.
134. A set of Membranous Apparatus to illustrate the mode of production of voice in the larynx, 7s. 6d.
135. Two Membranes to illustrate the vibration of the chordæ vocales, 2s. 6d.
136. Apparatus for showing the inferior limit of audibility; that is, if regular impulses occur with less than a certain degree of frequency, the ear ceases to receive the impression of a continuous tone. This consists of a spur-wheel, which can be made to rotate with considerable rapidity; the rays pass edgewise through a narrow slit, and striking the air in passing, produce a series of regular impulses, £9 9s., £13 13s.

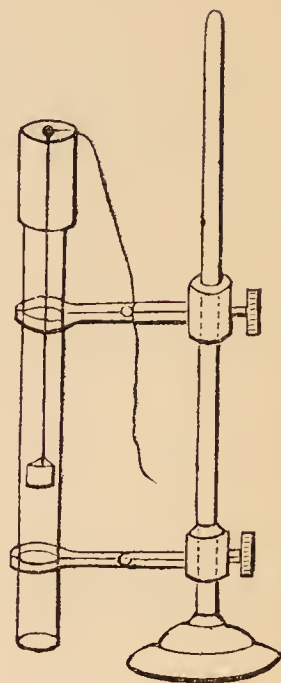
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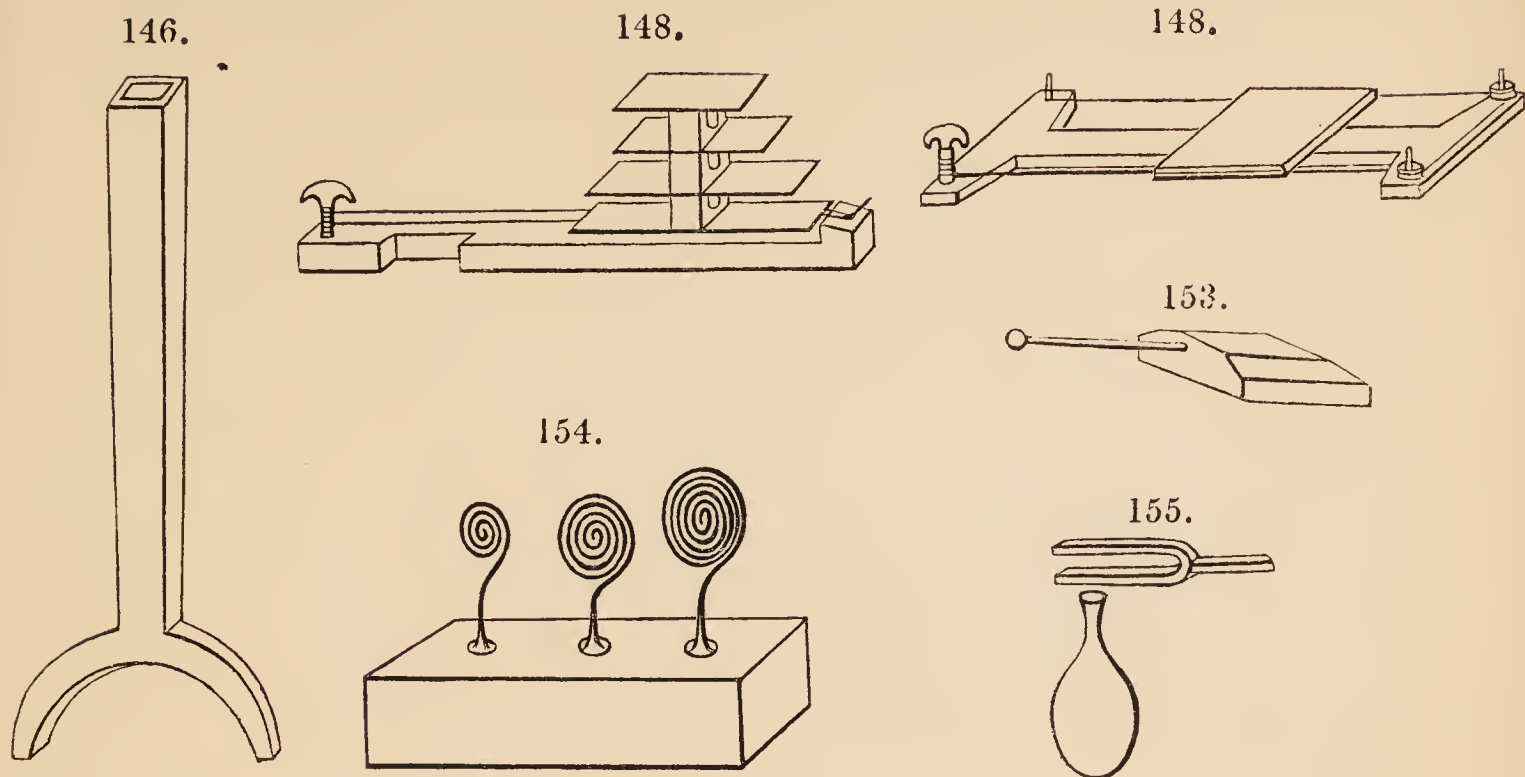
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137. Apparatus to show the superior limit of the frequency of vibrations producing an audible sound, consisting of a wheel with a large number of teeth, which, by means of a fly-wheel and multiplier, is made to revolve with great rapidity, a piece of quill being held against the teeth of the revolving wheel; as the speed increases the note produced rises in acuteness, and at length becomes inaudible. To this is added another apparatus for showing the constant relation of musical intervals, consisting of a set of toothed wheels revolving on the same axis, with different numbers of teeth. Of these some will give the notes of a common chord, whatever may be the velocity, while the others will produce discord with any of the former, but will be octaves to each other, £9 9s.
138. Stands for holding rods, to show their transverse vibrations; standards are fitted to these, by which the rods may be clamped at one or more nodal points, or supported at one or both ends. By one of these it may be shown that if a rod resting at both ends is made to vibrate, the first harmonic division will give the double octave to the fundamental note and not the octave, as in the case of the vibrating chord. With steel, wood, and glass rods, and glass tubes, £1 15s.
139. Clamps for holding longer rods and glass tubes to show their longitudinal undulations. For this purpose paper rings are arranged along the rod, which will be collected at the nodal points. By placing a series of paper rings outside, and of pith-balls inside a glass tube, the spiral nodal lines may be traced out. With glass tubes and rods, £1 11s. 6d.
140. A series of Six Glass Plates of different forms to show the vibrations of elastic surfaces by strewing them with sand, and throwing them into vibration with a violin bow, 9s.
141. Large Double Brass Clamp for holding the glass plates, 18s.
142. Apparatus to show the motion of the nodes in plates, 10s. 6d., 15s., £1 1s.
143. A Square, Circular and Triangular Frame, over which is stretched a delicate tissue to show the vibration of elastic membranes, 15s.
144. Apparatus for exhibiting the nodes of a bell, consisting of a large glass vessel, over the rim of which is suspended an equidistant row either of eight or twelve cork balls, the glass vessel being set in vibration by a violin bow, £1 12s., £1 18s.
145. Hopkins's Apparatus to show the nodes of the air in a tube, £1 11s. 6d.
146. Hopkins's Apparatus to show the interference of sound, consisting of a compound tube with two equal and similar branches ending in a trunk, 10s. 6d.
147. Iron Bar with sounding board attached to one end, to exhibit a sound produced by interrupting a galvanic circuit, 10s. 6d., 15s.
148. Various Apparatus for showing that sonorous vibrations are always transmitted in the same direction as that in which they were originally propagated.
- 1st. Apparatus to show the communication of the transverse vibrations of a chord to a series of parallel elastic surfaces, 15s.
- 2nd. Apparatus to show the longitudinal vibrations of a rod communicated to a series of parallel discs placed transversely to it, 15s.



3rd. Apparatus, in which the transverse vibrations of a chord are transferred to an elastic membrane, showing likewise the tangential vibrations of a membrane, 18s.

4th. Apparatus for showing the transmission of undulations from a rod to a fluid, and through the fluid to an elastic surface suspended in it, £1 11s. 6d.

149. Apparatus to show the effects of the interference of sonorous undulations, and the analogies existing between these and the interference of light.

1st. Experiment with a vibrating reed and two reciprocating tubes: if these are placed at right angles to each other before a vibrating reed, no resonance takes place; either being removed, resonance is immediately heard.

2nd. A Tuning-Fork held over the mouth of a reciprocating tube: no resonance takes place if the fork is held at an angle of 45° to the plane in which its excursions take place.

3rd. A Rotating Tuning-Fork: no sound is heard while rotation continues.

4th. Wheatstone's experiment with a tuning-fork attached to a stem: when vibrating, if it is held vertically with the end of the stem resting on a table, a resonance is heard, whether the end of the stem is at rest or is moved upon the table; but if held obliquely, resonance is perceived only when the stem is at rest, £2 2s., £3 3s.

150. Glass Rod with square or circular discs attached, to show Faraday's experiments on the influence of the density of the surrounding medium on the acoustic figures produced.

151. Series of Glass Tubes to illustrate the vibrations of a column of air in tubes closed at one end, 10s. 6d.

152. Uniform Strip of Steel Bar to illustrate Chladni's method for determining the number of vibrations made by a body emitting musical sounds, 7s. 6d.

153. Trevyllian's experiment, consisting of a brass bar, which when heated produces a musical note by oscillating on a cold block of lead, 15s.

154. Set of Steel Spirals mounted on a sounding board, with a hammer, £2 2s.

155. Tuning-Fork and Glass Flask for showing the polarization of sound, 8s. 6d.

156. Tuning-Fork attached to a jointed rod to show the polarization of sound.

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